Massachusetts Airport Pavement Management System

2017 EXECUTIVE SUMMARY

PREPARED FOR

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applied pavement TECHNOLOGY

OVERVIEW

BACKGROUND

The Massachusetts airport system plays a vital role in supporting economic development opportunities statewide. The pavements at these airports represent the largest capital investment in the Massachusetts airport system, and the condition of these pavements is important both from a cost-effective approach to maintaining them as well as providing safe facilities that continue to foster economic opportunity. Timely airport pavement maintenance and rehabilitation (M&R) are crucial because repairs become much more expensive once the conditions deteriorate below certain levels. Additionally, certain airport pavement distresses, such as wide cracking and loose debris, pose a significant safety risk to aircraft.

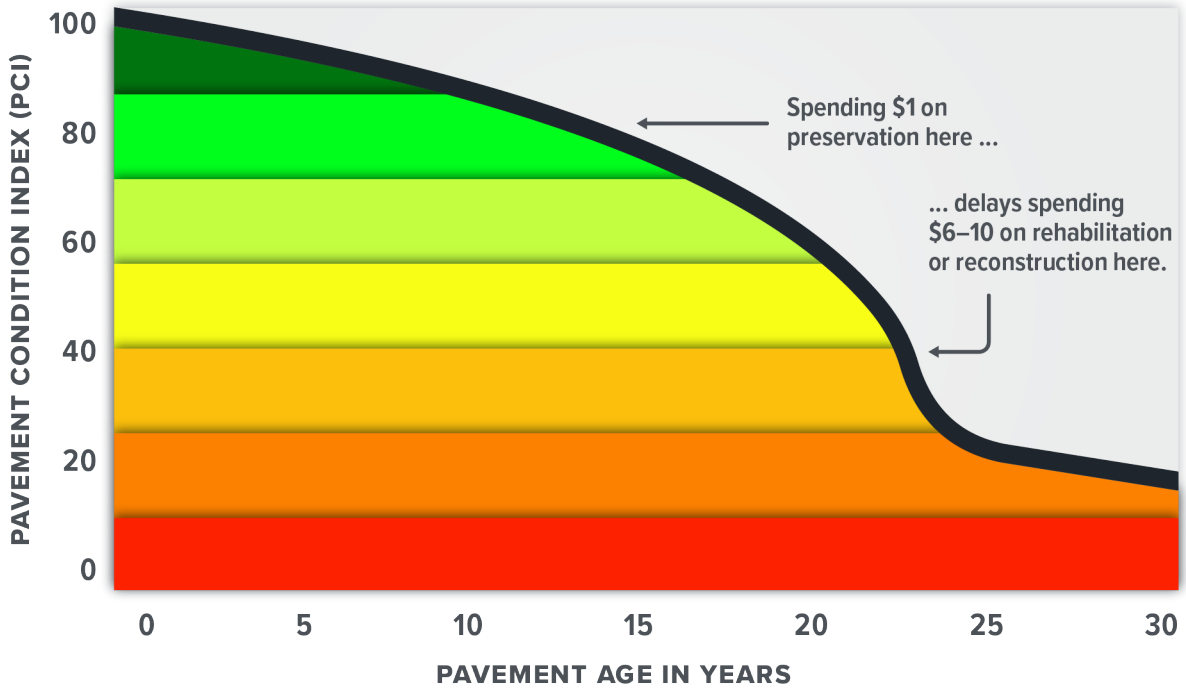
Recognizing a need to protect this critical investment, the Massachusetts Department of Transportation Aeronautics Division (MassDOT Aeronautics) maintains an airport pavement management system (APMS). The APMS provides subject airports, MassDOT Aeronautics, and the Federal Aviation Administration (FAA) with objective data on airport pavement conditions and is used to proactively anticipate needs and plan for the capital investments required to preserve the system.

During this project, a pavement condition assessment was undertaken at thirty-three Massachusetts airports during Fall 2016. The collected pavement inventory and condition data were used to update the APMS database and analyzed to determine overall condition levels, identify pavement-related needs, and develop a 6-year M&R plan for the subject airports. The total cost of needs determined through this project reflect costs for pavement-related work itself and do not include any additional costs for items such as design, lighting, signage, construction monitoring, marking, or contingency fees. Actual final project costs may be substantially greater depending on these individual factors. This report describes the findings and recommendations of the APMS project.

BENEFITS OF THE AIRPORT PAVEMENT MANAGEMENT SYSTEM

The MassDOT Aeronautics APMS yields many benefits. It provides MassDOT Aeronautics, the individual airports, and the FAA with the information needed to monitor the condition of the pavements to ensure they are able to safely accommodate aircraft operations. The APMS also provides MassDOT Aeronautics with a tool that can be used to make cost-effective decisions about the M&R of the pavement infrastructure and to evaluate the long-term impacts of the decision-making. The APMS fulfills many of the National Plan of Integrated Airport Systems (NPIAS) requirements of Public Law 103-305 and Grant Assurance 11 for maintaining a pavement maintenance management system.

The APMS also identifies when different pavement strategies would be most appropriate. The timing of projects is important because preventive maintenance, such as crack sealing and surface treatments, can cost-effectively extend the life of a pavement. Once preventive maintenance is no longer the appropriate action, it is critical to perform major rehabilitation, such as an overlay or surface reconstruction, as soon as possible before the pavement structure becomes so degraded that the only viable alternative is complete reconstruction. The financial impact of delaying repairs until this point is reached can be severe, as reconstruction can cost many times the cost of less comprehensive rehabilitation, such as an overlay. In addition, there is a point when the pavement becomes unsafe for aircraft operations.



PROJECT AIRPORTS

The thirty-three airports shown in the figure below were evaluated during the MassDOT Aeronautics APMS update.

The pavement area evaluated at these airports is approximately 43 million square feet (40 percent runway, 28 percent taxiway, 25 percent apron/helipad, and 7 percent T-hangar). The breakout of pavement area by airport role, as defined in the Massachusetts Statewide Airport System Plan (MSASP), is 38 percent commercial/scheduled service airports, 46 percent corporate/business airports, 13 percent community/business airports, and 3 percent essential/business airports. In addition to these breakdowns, approximately 96 percent of the pavement included, consisting of 41.8 million square feet, is located on NPIAS airports, 4 percent, or 1.6 million square feet, on non-NPIAS airports.

PAVEMENT CONDITION ASSESSMENT

PCI	TYPICAL PAVEMENT SURFACE
80	
53	
9	

PAVEMENT CONDITION INDEX

The pavements were evaluated using the Pavement Condition Index (PCI) procedure, documented in FAA Advisory Circular (AC) 150/5380-6C, *Guidelines and Procedures for Maintenance of Airport Pavements*, FAA AC 150/5380-7B, *Airport Pavement Management Program (PMP),* and ASTM D5340-12, *Standard Test Method for Airport Pavement Condition Index Surveys*. This procedure is the standard used in the United States to visually assess and monitor the condition of airport pavements. Established in the early 1980s, it provides a consistent, objective, and repeatable method to evaluate overall pavement conditions. PCI data are also used to identify the most cost-effective repair type and timing of that repair.

During a PCI survey, a visual inspection of a pavement's surface is performed to quantify the types, severities, and amounts of pavement distress observed. This information is then used to develop a composite index that represents the overall condition of the pavement in numerical terms, ranging from 0 (failed) to 100 (excellent). A statistical approach is then used to estimate the total quantity of distress and overall condition of the pavement section. The figure to the left is a visual representation of the PCI scale.

TYPICAL DISTRESS TYPES

Following is a description of the pavement distresses most commonly observed at the Massachusetts airports included in this project. The description is limited to asphalt-surfaced pavements, because the majority of the airport infrastructure consists of this type of pavement.

ALLIGATOR CRACKING

Alligator cracking is a load-related distress caused by excessive tensile strains at the bottom of the asphalt (AC) layer or stabilized asphalt base layer from repeated aircraft loadings. It typically shows up on the surface as a series of parallel cracks, which eventually interconnect to form a pattern resembling the skin of an alligator.

BLOCK CRACKING

This distress generally appears over relatively large areas as a series of cracks arranged in a pattern of square or rectangular blocks. It is caused by shrinkage of the pavement over time and the repeated deformation caused by daily temperature cycles. It is not a load-related distress, and its occurrence usually indicates that the pavement has significantly hardened.

LONGITUDINAL AND TRANSVERSE (L&T) CRACKING

L&T cracking can be caused by any of the following: 1) separation of pavement at paving lane joints, 2) shrinkage of AC pavement due to temperature differentials in older or brittle pavements, or 3) reflection cracking from underlying existing cracking in overlaid pavements.

PATCHING AND UTILITY CUT PATCH

Patching is a localized repair often used to address distresses such as wide cracks. Patching is also used to repair areas after the installation of underground utilities, and is considered a defect no matter how well it is performing.

WEATHERING

As pavements age and are exposed to oxidation and other environmental stresses, they may experience a loss in the material making up the pavement matrix. Weathering is the loss of the asphalt binder and fine aggregate.

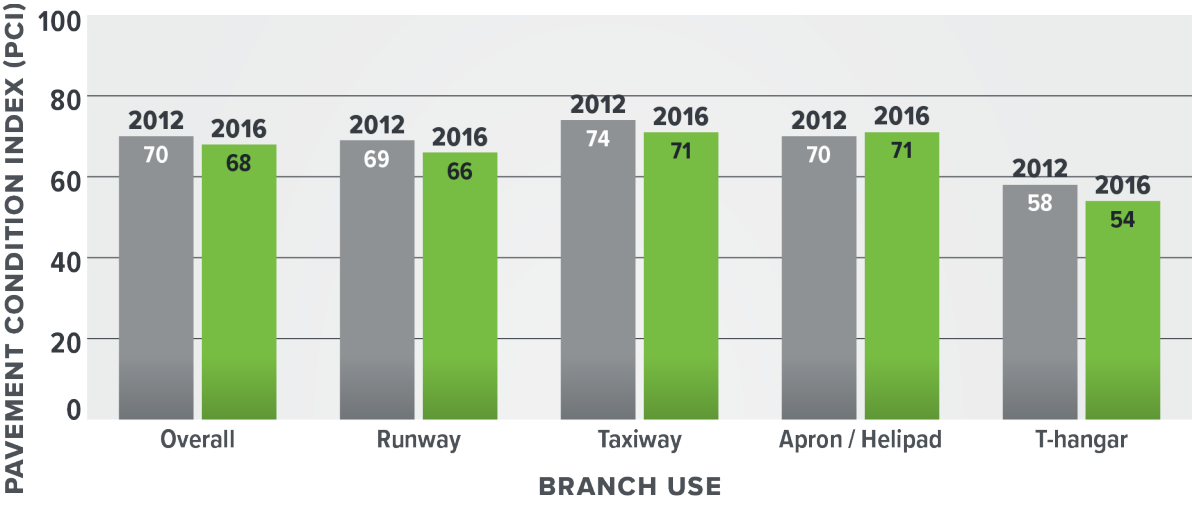
RAVELING

Raveling occurs as the coarse aggregate on an asphalt surface becomes dislodged and produces loose pieces called foreign object debris (FOD). FOD poses a safety hazard as it may cause serious damage to aircraft engines and equipment.

PAVEMENT CONDITION RESULTS

OVERALL PAVEMENT CONDITION

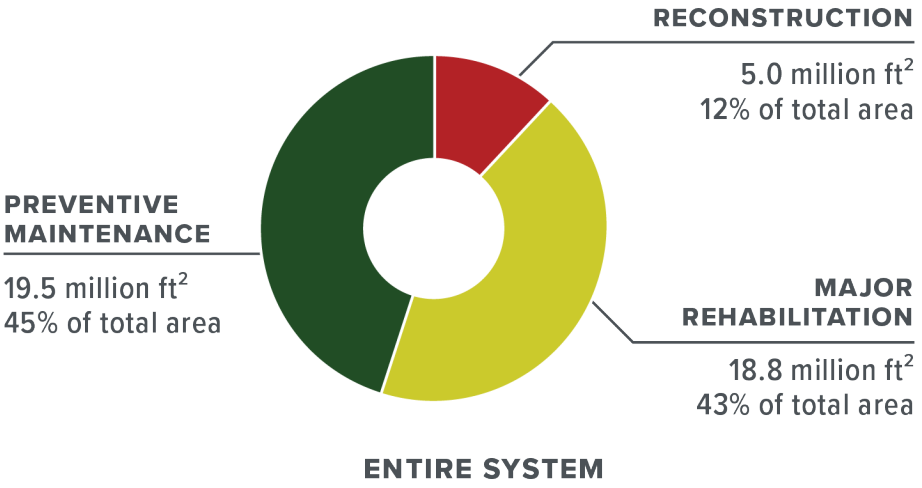
The overall area-weighted PCI (average PCI adjusted to account for the relative size of the pavement sections) of the thirty-three airports was 68 at the end of 2016. This is compared to an area-weighted PCI of 69 for the twenty-two public airports and 47 for the eleven private airports included in the system. This can be compared to the 2012 PCI of 70. The following figures show the 2012 versus 2016 area-weighted condition of the pavement broken out by pavement use and by airport classification.



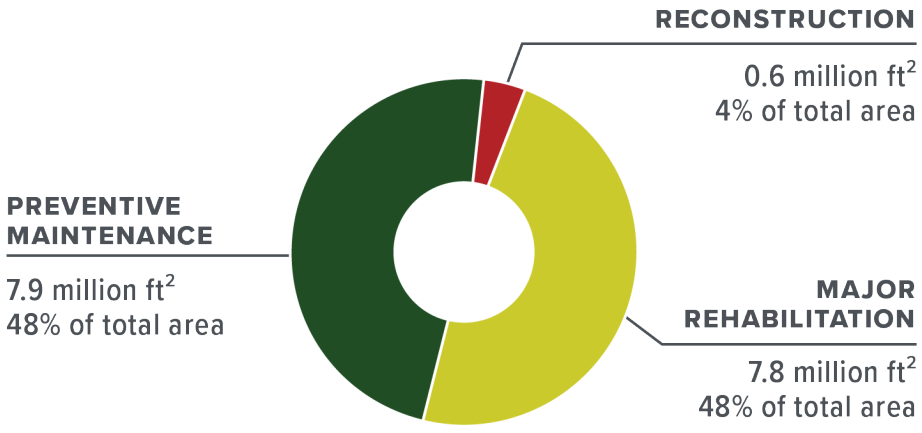
PAVEMENT NEEDS ASSESSMENT

Approximately 45 percent of the pavement area at the project airports is at a condition level (assumed to be a PCI greater than 70) where timely preventive maintenance such as crack sealing and surface treatments will cost-effectively slow the rate of deterioration and approximately 12 percent has fallen to a PCI (assumed to be 40 or lower) where reconstruction may be needed. The remaining 43 percent of the pavement infrastructure is estimated to need rehabilitation such as an overlay.

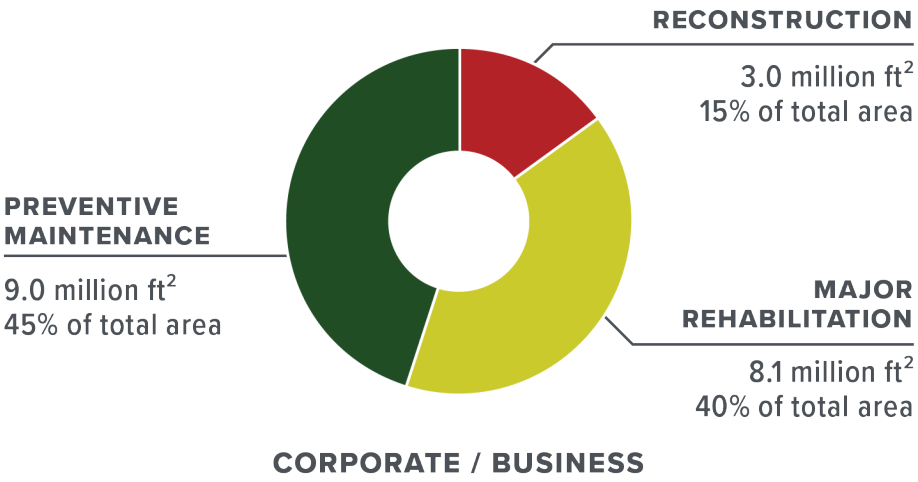
The following figures show the percentage of pavement estimated to require each level of repair (preventive maintenance, rehabilitation, and reconstruction). The largest percentage of overall pavement area possibly needing reconstruction to restore operational condition is at the essential/ business airports and the smallest percentage of pavement area in possible need of reconstruction is at the commercial service/scheduled charter airports.



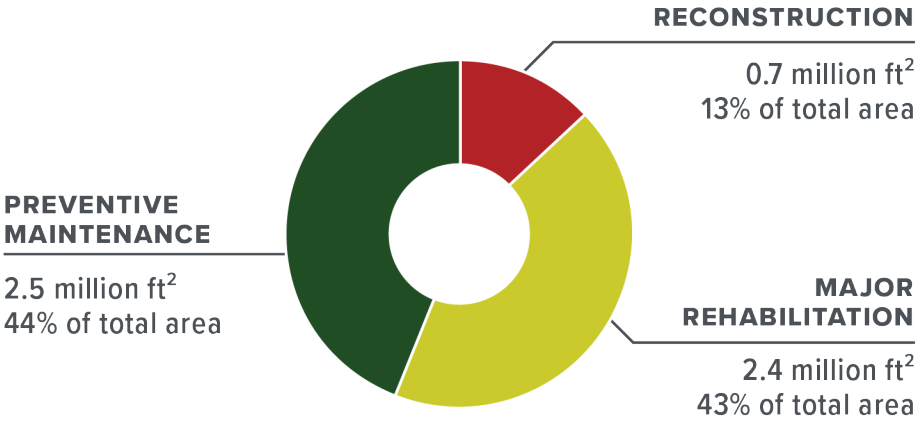
ENTIRE SYSTEM



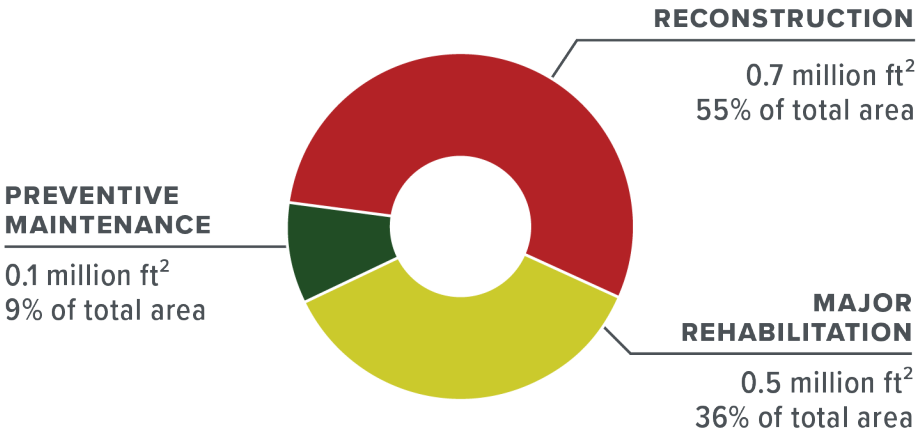
COMMERCIAL SERVICE / SCHEDULED CHARTER



CORPORATE / BUSINESS



COMMUNITY / BUSINESS



ESSENTIAL / BUSINESS

ADDRESSING PAVEMENT NEEDS

An analysis was performed to develop an approach for addressing pavement needs anticipated for the next 6 fiscal years (FY2018 to FY2023). For each fiscal year of the analysis, the future conditions of the pavements were predicted and a determination was made as to whether preventive maintenance or major rehabilitation/reconstruction was the appropriate and most cost-effective strategy. The pavement was recommended for preventive maintenance if it was projected to be above a PCI of 65 for aprons and T-hangars; 70 for taxiways and helipads; and 75 for runways. Below these PCI thresholds, major rehabilitation/reconstruction was recommended, and the cost for the major rehabilitation/reconstruction work was then estimated.

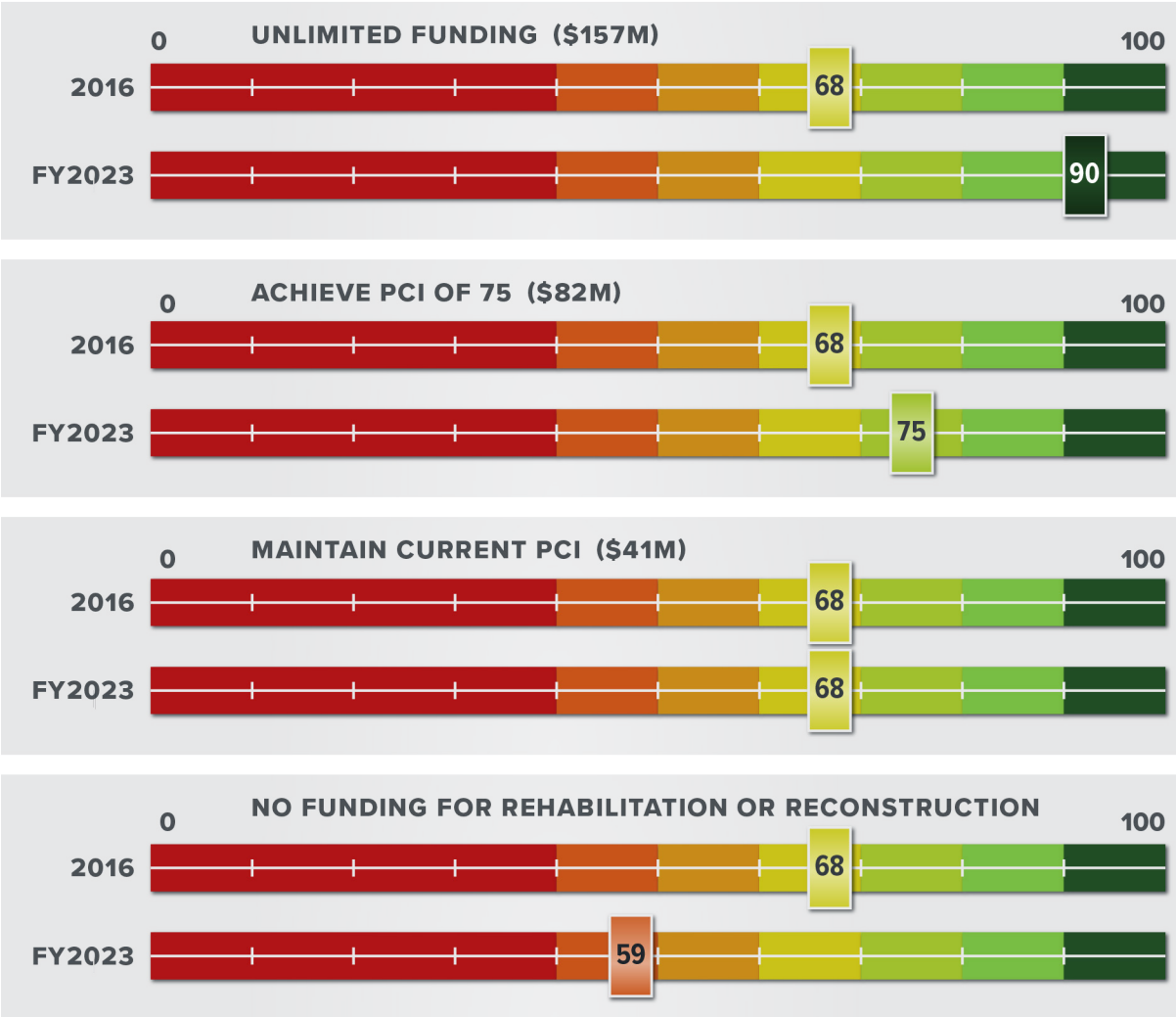
FUNDING LEVELS

To provide a baseline, if no funding is provided for major rehabilitation/reconstruction, pavement conditions will steadily decline at Massachusetts airports, with a forecasted system-wide PCI of 59 by the end of FY2023. This decrease would result in an increased need for major rehabilitation or reconstruction, which in turn would substantially increase the costs to keep the pavement system in a safe and serviceable condition.

In contrast, if all viable identified major rehabilitation and reconstruction projects were funded, approximately $157 million would be needed during the next 6 fiscal years—$60 million for commercial service/scheduled charter airports, $69 million for corporate/business airports, $19 million for community/business airports, and $9 million for essential/business airports. Of this amount, approximately $146 million is needed for NPIAS airport pavement work and $11 million for non-NPIAS airport pavements. This amount only reflects costs for the pavement work itself and does not include any other costs such as design, lighting, signage, construction monitoring, marking, or contingency fees. If all of the projects identified are completed at the time that they are recommended, a resulting system-wide PCI of 90 is forecasted at the end of FY2023.

Since the unlimited funding scenario is unrealistic from a budgetary standpoint, two additional analyses were investigated to determine the funding required to either maintain the pavement system at its current PCI of 68 or to increase and achieve the PCI to 75. It was determined that a fiscal funding level of approximately $14 million would allow the desired pavement condition goal of an area-weighted PCI of 75 to be achieved through FY2023 and approximately $7 million to maintain the current area-weighted PCI of 68.

PROJECTED PAVEMENT CONDITION INDEX BY SCENARIO



The funding needs through FY2023 for each airport under an unlimited budget are summarized in the table on the next page.

FY2018–FY2023 UNLIMITED FUNDING NEEDS

COMMERCIAL SERVICE/SCHEDULED CHARTER		
Airport Name	**2016 Area-Weighted PCI**	**6-Year Total Funding Needs for Major Rehabilitation/ Reconstruction**
Barnstable Municipal – Boardman/Polando Field	75	$13.0M
Martha's Vineyard Airport	68	$10.1M
Nantucket Memorial Airport	71	$12.7M
New Bedford Regional Airport	73	$10.6M
Provincetown Municipal Airport	75	$1.6M
Westover Metropolitan Airport	69	$11.8M
COMMERCIAL SERVICE/SCHEDULED CHARTER TOTALS	**72**	**$60M**

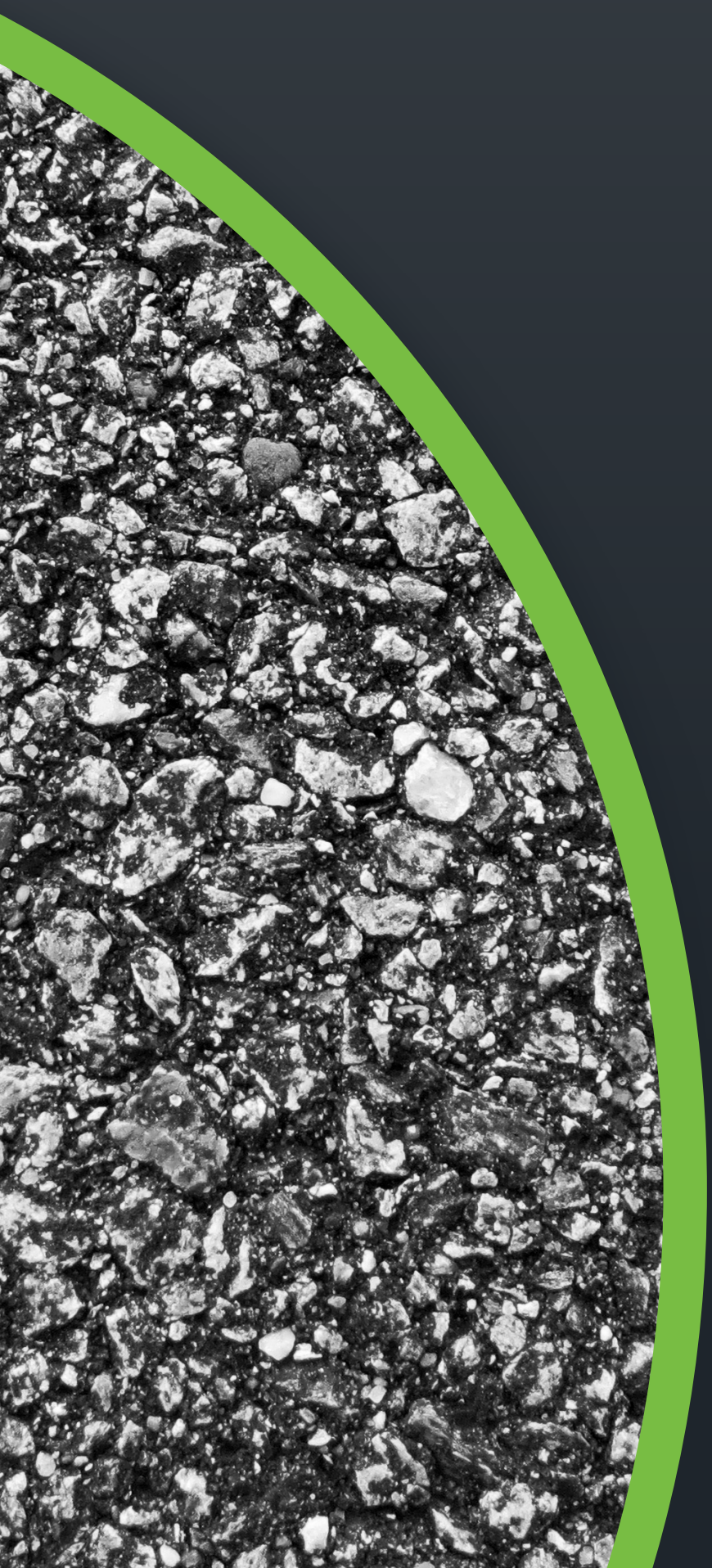
CORPORATE/BUSINESS		
Airport Name	**2016 Area-Weighted PCI**	**6-Year Total Funding Needs for Major Rehabilitation/ Reconstruction**
Beverly Regional Airport	76	$5.3M
Fitchburg Municipal Airport	43	$11.0M
George Harlow Field – Marshfield Municipal Airport	89	$0.8M
Harriman-and-West Airport – North Adams Airport	89	$1.5M
Lawrence Municipal Airport	56	$11.4M
Norwood Memorial Airport	78	$4.4M
Orange Municipal Airport	67	$3.7M
Pittsfield Municipal Airport	45	$10.7M
Plymouth Municipal Airport	68	$7.9M
Westfield-Barnes Regional Airport	72	$12.0M
CORPORATE/BUSINESS TOTALS	**67**	**$69M**

COMMUNITY/BUSINESS		
Airport Name	**2016 Area-Weighted PCI**	**6-Year Total Funding Needs for Major Rehabilitation/ Reconstruction**
Chatham Municipal Airport	77	$1.7M
Falmouth Airpark	65	$0.5M
Mansfield Municipal Airport	65	$3.1M
Marlboro Airport	26	$1.3M
Minute Man Air Field	60	$1.7M
Northampton Airport	72	$1.5M
Southbridge Municipal Airport	57	$2.4M
Spencer Airport	5	$1.1M
Sterling Airport	52	$1.5M
Taunton Municipal Airport – King Field	74	$2.1M
Turners Falls Municipal Airport	84	$0.9M
Walter J Koladza Airport - Great Barrington Airport	44	$1.5M
COMMUNITY/BUSINESS TOTALS	**65**	**$19M**

ESSENTIAL/BUSINESS		
Airport Name	**2016 Area-Weighted PCI**	**6-Year Total Funding Needs for Major Rehabilitation/ Reconstruction**
Cranland Airport	70	$0.5M
Gardner Municipal Airport	56	$2.2M
Hopedale Industrial Park Airport	24	$3.4M
Plum Island Airport	31	$1.2M
Tanner-Hiller Airport	9	$1.7M
ESSENTIAL/BUSINESS TOTALS	**41**	**$9M**

SUMMARY

- Thirty-three airports are included in the MassDOT Aeronautics APMS: six commercial service/ scheduled charter and twenty-seven general aviation airports.
- The total area of pavement included in the MassDOT Aeronautics APMS database is 43.3 million square feet. This can be further broken down into 17.4 million square feet of runway pavement, 11.8 million square feet of taxiway pavement, 10.8 million square feet of apron/helipad pavement, and 3.2 million square feet of T-hangar pavement.
- The pavement system has an area-weighted PCI of 68. Approximately 45 percent of the pavement area is at a condition level where preventive maintenance, such as crack sealing, is a cost-effective approach to maintaining the pavement. However, 55 percent of the pavement area has deteriorated to the condition where major rehabilitation or reconstruction is needed.
- If no funding for pavement major rehabilitation or reconstruction is provided, the overall area-weighted PCI of the system will deteriorate to an estimated 59 and accrue a funding backlog of $195 million for major rehabilitation and reconstruction by FY2023.
- If all the projects identified as needing pavement major rehabilitation or reconstruction are funded, approximately $157 million will be needed over the next 6 years: $60 million for commercial service/ scheduled charter airports and $97 million for general aviation airports. Approximately $146 million is needed for NPIAS airport pavement work and $11 million for non-NPIAS airport pavement work.
- To achieve the desired pavement condition goal of an area-weighted PCI of 75 for the entire system by FY2023, approximately $14 million of annual funding is needed over the next 6 years.
- To maintain the current area-weighted PCI of 68 for the entire system through FY2023, approximately $7 million annual expenditure is needed over the next 6 years.



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